

POSITION STATEMENT

Alcohol and cancer risk



Key messages and recommendations

- Alcohol use is a cause of cancer. Any level of alcohol consumption increases the risk of developing an alcohol-related cancer; the level of risk increases in line with the level of consumption.
- It is estimated that 5,070 cases of cancer (or 5% of all cancers) are attributable to long-term, chronic use of alcohol each year in Australia.
- There is convincing evidence that alcohol use increases the risk of cancers of the mouth, pharynx, larynx, oesophagus, bowel (in men) and breast (in women), and probable evidence that it increases the risk of bowel cancer (in women) and liver cancer. (Convincing and probable are the highest levels of evidence as determined by the World Cancer Research Fund and American Institute for Cancer Research and denote that the relationship is causal or probably causal in nature).
- Together, smoking and alcohol have a synergistic effect on cancer risk, meaning the combined effects of use are significantly greater than the sum of individual risks.
- Alcohol use may contribute to weight (fat) gain, and greater body fatness is a convincing cause of cancers of the oesophagus, pancreas, bowel, endometrium, kidney and breast (in post-menopausal women).
- Cancer Council recommends that to reduce their risk of cancer, people limit their consumption of alcohol, or better still avoid alcohol altogether.
- For individuals who choose to drink alcohol, Cancer Council recommends that they drink only within the National Health and Medical Research Council (NHMRC) guidelines for alcohol consumption.

Introduction

Alcohol use is widespread in Australia and has had a dominant role in defining Australian culture for more than 200 years.(1;2) However, it is also an important cause of illness, injury and death, whether resulting from short-term episodes of intoxication or from long-term, chronic use.(3)

Addressing the health and social damage resulting from risky drinking is one of the three key priority areas identified by the Australian National Preventative Health Taskforce.(4) Levels of harm from alcohol use are increasing, and a range of policy measures have been proposed to address the current drinking 'culture' in Australia.(4)

In this position statement, Cancer Council Australia provides a brief overview of the evidence concerning alcohol use and cancer, and gives its current recommendations regarding alcohol consumption.

Evidence linking alcohol and cancer

It has been known for more than 20 years that long-term chronic use of alcohol can cause cancer. In 1988, the International Agency for Research on Cancer (IARC) stated that 'the occurrence of malignant tumours of the oral cavity, pharynx, larynx, oesophagus and liver is causally related to the consumption of alcoholic

beverages' and classified alcoholic beverages as Group 1 carcinogens—known to cause cancer in humans.(5) Ethanol, the chemical present in all alcoholic beverages and which induces the altered physical and mental responses experienced with alcohol use, has also been listed as a Group 1 carcinogen.(6)

The most recent comprehensive review of the scientific evidence by the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) concluded that there is convincing evidence that alcohol is a cause of cancer of the mouth, pharynx, larynx, oesophagus, bowel (in men) and breast (in women), and probable evidence that alcohol increases the risk of bowel cancer (in women) and liver cancer.(7) Convincing and probable are the two highest levels of evidence set by the World Cancer Research Fund and American Institute for Cancer Research that identify a causal relationship between a particular aspect of food, nutrition, physical activity or body composition, and cancer.(7) Scientific research is continuing to identify other cancers that could be associated with alcohol use. For example, there is some evidence that heavy alcohol consumption may be associated with a higher risk of prostate cancer.(8;9)

There is a dose-response relationship between alcohol and cancer risk for men and women, with studies showing that the risk of cancer increases with increasing consumption of alcohol on a regular basis.(7;10-12)

There are a number of biological mechanisms that may explain alcohol's contribution to cancer development. Ethanol may cause cancer through the formation of acetaldehyde, its most toxic metabolite. Acetaldehyde has mutagenic and carcinogenic properties, and bonds with DNA to increase the risk of DNA mutations and impaired cell replication.(13;14) Ethanol may also cause direct tissue damage by irritating the epithelium and increasing the absorption of carcinogens through its effects as a solvent.(7) In addition, alcohol can increase the level of hormones such as oestrogen, thereby increasing breast cancer risk,(7) and increase the risk of liver cancer by causing cirrhosis of the liver, increased oxidative stress, altered methylation and reduced levels of retinoic acid.(14) Lifestyle factors such as smoking, poor oral hygiene, and certain nutrient deficiencies (folate, vitamin B6, methyl donors) or excesses (vitamin A/ β -carotene), owing to poor diet or self-medication, may also increase the risk for alcohol-associated tumours.(14)

Estimates of cancer incidence attributable to alcohol use in Australia

Several estimates of the numbers of cases of cancer attributable to alcohol use in Australia have been calculated using different methods.(3;15-17) However, these calculations pre-date the confirmation of alcohol use as a convincing cause of bowel cancer in men. Because the incidence of bowel cancer in Australia is high,(18) calculations which exclude bowel cancer are likely to lead to a substantial underestimate of the true burden of alcohol-caused cancer in Australia.

In order to estimate the incidence of cancer in Australia attributed to alcohol use, Table 1 provides a complete set of attributable fractions for cancers associated with alcohol for the United Kingdom, collated by the World Cancer Research Fund(19) and applied to Australian cancer incidence data for 2005.(18) Attributable fractions for the UK have been used here, on the assumption that Australian patterns of drinking more closely mirror those in the UK than those in the USA, Brazil or China, the other countries for which the World Cancer Research Fund presented data.

Using this method, it is estimated that 5,070 cases of cancer (or 5% of all cancers) are attributable to long-term, chronic use of alcohol each year in Australia. This figure includes cancers for which there is convincing evidence that alcohol use increases the risk of disease. When cancers for which the risk is probably increased by alcohol use are included, the tally rises to 5,663 (or 5.6% of all cancers).

Table 1: Estimated incidence of cancers caused by alcohol use in Australia, applying population attributable fractions for the UK to Australian cancer incidence data for 2005

Cancer site	Population attributable fraction %(19)	Incidence 2005(18)	Incidence attributable to alcohol use
Cancers for which there is convincing evidence that alcohol use increases risk[3]			
<i>Mouth, pharynx, larynx</i>	41	3,161	1,296
<i>Oesophagus</i>	51	1,165	594
<i>Bowel in men</i>	7	7,181	503
<i>Breast in women</i>	22	12,170	2,677
<i>Sub total</i>			5,070
<i>Percentage of all cancers</i>			5.0%
Cancers for which risk is probably increased by alcohol use[3]			
<i>Bowel in women</i>	7	5,895	413
<i>Liver</i>	17	1,060	180
<i>Sub total</i>			593
<i>Percentage of all cancers</i>			0.6%
<i>Total convincing and probable</i>			5,663
<i>Total (convincing and probable) as a percentage of all cancers</i>			5.6%

Sources: World Cancer Research Fund and the American Institute for Cancer Research;(7;19) Australian Institute of Health and Welfare(18)

Burden of disease and injury

Australian data show that alcohol is an important contributor to the overall burden of disease and injury in Australia.(3) Burden of disease and injury is measured in disability-adjusted life years (DALYs), which calculate the amount of time lost due to both fatal and non-fatal events; that is, years of life lost due to premature death coupled with years of “healthy” life lost due to disability.(3) In 2003, alcohol was ranked sixth after tobacco, high blood pressure, high body mass, physical inactivity and high blood cholesterol as a cause of burden of disease and injury in Australia.(3) Alcohol was responsible for 3.1% of the burden of disease and injury due to cancer.(3)

Because alcohol is frequently consumed in excess by young people, it is responsible for many lost years of life.(20) The financial cost of disease, injury and crime caused by alcohol in Australia has been estimated to be about \$15.3 billion.(15) The proportion of these costs which can be attributed to alcohol-related cancer is not specified.(15)

Combined effects of drinking and smoking

For some cancers the combined effects of drinking alcohol and smoking tobacco greatly exceed the risk from either factor alone. Smoking and alcohol together have a synergistic effect on upper gastrointestinal and aerodigestive cancer risk.(21) Compared with non-smoking non-drinkers, the approximate relative risks for developing mouth and throat cancers are up to seven times greater for people who smoke tobacco, up to six

* These data pre-date confirmation that bowel cancers are caused by alcohol use and are therefore likely to be an underestimate.

times greater for those who drink alcohol, but more than 35 times greater for those who are regular, heavy users of both substances (consuming more than four alcoholic drinks and smoking forty or more cigarettes daily).(22) The synergistic effect of alcohol and smoking has been estimated to be responsible for more than 75% of cancers of the upper aero-digestive tract in developed countries.(22)

Alcohol and weight gain

The relationship between alcohol consumption and body weight and fat is complex and appears to vary with sex and drinking pattern.(23) From a nutritional viewpoint, alcoholic drinks represent 'empty kilojoules'—that is, alcoholic drinks are high in kilojoules but low in nutritional value, especially when added to sugary mixer drinks. Alcohol itself has a comparatively high energy content (29 kilojoules per gram) compared with other macronutrients.(24)

If people drink alcohol in addition to their normal dietary intake – that is, without a compensatory reduction in energy intake – they are liable to gain weight. Alcohol provides extra kilojoules and slows fat and carbohydrate oxidation. On the other hand, if drinking replaces healthy eating patterns, it can lead to nutritional deficiencies and serious illness.(23;25)

Therefore as well as being a direct cause of several cancers, alcohol might also contribute indirectly to those cancers associated with excess body fatness. There is convincing evidence that body fatness increases the risk of cancers of the oesophagus, pancreas, bowel, breast (in post menopausal women), endometrium and kidney, and probable evidence that body fatness increases the risk of gallbladder cancer.(7)

Alcohol and heart disease

The potential benefit of light to moderate alcohol consumption on cardiovascular disease is the subject of ongoing scientific debate. A number of population studies, including a 2011 systematic review(31) have suggested light to moderate alcohol consumption may reduce the risk of cardiovascular disease. However, other reviews have suggested unmeasured confounding in epidemiological studies on alcohol and heart disease is widespread and that randomised controlled trials may be the only way to obtain more consistent evidence about the effects of moderate alcohol consumption on cardiovascular disease risk.(26)

Conclusive evidence shows higher levels of alcohol consumption confer no cardiovascular health benefits.(26) The 2011 review that suggested moderate alcohol consumption may reduce cardiovascular disease risk also linked higher alcohol consumption levels with an increased risk of stroke.(31) Neither the World Health Organization nor the National Heart Foundation of Australia recommend consuming red wine or any other alcoholic beverage to prevent cardiovascular disease.(26;32)

Alcohol consumption in Australia

Adults

In 2007, 83% of Australians aged 14 or older had consumed at least one drink in the previous year ("recent drinkers").(1) Of recent drinkers, about half drank on a weekly basis, and one in ten drank daily. Seventeen percent of adults were either ex-drinkers or never-drinkers. Males were more likely to consume alcohol than females.(1)

Although most drinkers (61%) aged 14 years or older consumed alcohol at levels regarded as low risk to health in the short or long term, nearly one in 10 drinkers (8.6%) consumed alcohol at risky or high risk

quantities to their health in both the short and long term.(1)[#] These drinking patterns have persisted since 2001.(1) The majority of people classified as recent drinkers reported that they had made an effort to reduce their alcohol consumption. The most common reason given for doing so was because of health considerations.(1)

It is worth noting that the data on levels of personal alcohol consumption contained in these national surveys are based on self report by participants. When compared with the volume of alcohol known to be cleared for consumption (on the basis of statistics on sales figures, taxation and customs data) there is a significant shortfall. It is therefore probable that individuals under-report their personal levels of consumption.(34;35)

Quantities of alcohol consumed by Australian adults aged 15 years or over appear to have remained relatively stable over the past fifteen years at just fewer than 10 litres per capita.(36) Compared with other countries within the Organisation for Economic Cooperation and Development (OECD), Australia is middle ranking on the basis of per capita alcohol consumption.(36) In 2008, apparent per capita consumption of alcohol in the population aged 15 years or more was 9.95 litres, about half of which was consumed in the form of beer.(37) Consumption of ready-to-drink, pre-mixed spirits increased between 2006 and 2007 but has since stabilised.(37) Consumption of undiluted spirits dropped between 2006 and 2007 and increased between 2007 and 2008.(37) It is likely that these trends reflect alcohol taxation policy in place at the time.

Children

Experience with alcohol is common among teenagers, and likelihood of use increases with age.(38) *The Australian Secondary Students' Alcohol and Drug (ASSAD) survey (2005)* shows that by age 15 about 90% of students had tried alcohol, and by age 17, 70% of students consumed alcohol in the month prior to the survey.(38) The proportion of students drinking in the week prior to the survey increased with age, from 10% of those aged 12 to about half of 17-year-olds.(38) About 5% of 12- to 15-year-olds and 20% of 16- and 17-year-olds had consumed alcohol at levels which could lead to short term harm during the week prior to survey.~ Teenagers were most likely to drink alcohol in the form of pre-mixed drinks or spirits.(38)

Indigenous Australians

Although Aboriginal and Torres Strait Islander Australians are more likely to abstain from alcohol use than the non-Indigenous population, of those who do drink, a higher proportion drink at risky or high-risk levels.(39) In 2004-05, 29% of Indigenous Australians had not had a drink in the previous 12 months, about twice the prevalence of non-Indigenous Australians (15%).(39) Among the populations who had consumed alcohol, however, 34% of Indigenous Australians had consumed at long-term risky or high-risk levels, compared with 22% of non-Indigenous Australians.(39)

The effects of alcohol use are felt especially heavily in this population. In 2003, drinking caused 8% of all Indigenous deaths and was responsible for 6% of the total burden of disease and injury for Indigenous Australians,(40) approximately double that for the total Australian population.(3) Liver cancer, and cancers of the lip, mouth and pharynx occur at more than twice the rate[^] in Indigenous Australians compared with non-

[#] These measures are based on the NHMRC *Australian Alcohol Guidelines (2001)*.(33)

~ For the purposes of ASSAD, risk of short term harm is defined as follows: Those males who consumed seven or more alcoholic drinks on at least one day of the preceding seven days and those females who consumed five or more alcoholic drinks on at least one day of the preceding seven days.(38) These measures are based on the NHMRC *Australian Alcohol Guidelines (2001)* current at the time.(33)

[^] Age-standardised rate. These estimates are based on combined data from Cancer Registries in Western Australia, the Northern Territory and South Australia, and together provide the most detailed picture of Indigenous age-specific cancer incidence rates currently available.

Indigenous Australians.(41) The higher rates of liver cancer are likely to be attributable to elevated rates of infection with the hepatitis B virus and excessive alcohol consumption in some Indigenous males.(41) The likelihood of developing cancers of the lip, mouth and pharynx is elevated in people who use tobacco and who drink alcohol; and the risk is much higher in people who use both substances.(41) As well as risky drinking, smoking is more prevalent among Indigenous people than in the non-Indigenous population.(39)

Cancer Council Australia's recommendations on alcohol use

Alcoholic drinks and ethanol are carcinogenic to humans.(6;7) There is no evidence that there is a safe threshold of alcohol consumption for avoiding cancer, or that cancer risk varies between the type of alcoholic beverage consumed.(7)

Cancer Council recommends that to reduce their risk of cancer, people limit their consumption of alcohol, or better still avoid alcohol altogether. For individuals who choose to drink alcohol, consumption should occur within in the Australian National Health and Medical Research Council (NHMRC) guidelines.(42) Cancer Council Australia's key recommendations are summarised at the beginning of this statement and outlined in Box 1.

Cancer Council Australia is a strong advocate for evidence-based action to reshape social attitudes concerning drinking, and to reduce the burden of morbidity and mortality caused by alcohol use.

Box 1. Key evidence-based points and recommendations

- Alcohol use is a cause of cancer in humans (Group 1 carcinogen, highest level of evidence, classified by the International Agency for Research on Cancer (IARC)).(5;6)
- Ethanol, the chemical present in all alcohol beverages, is also a cause of cancer in humans (Group 1 carcinogen, classified by the IARC).(6)
- There is convincing evidence that alcohol use increases the risk of cancers of the mouth, pharynx, larynx, oesophagus, bowel (in men) and breast.(7) (Convincing evidence, as classified by the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR), is the strongest level of evidence and denotes a causal relationship*).
- Alcohol use probably increases the risk of bowel cancer (in women) and liver cancer. (A probable relationship, as classified by the WCRF and the AICR, is the second highest level of evidence and denotes that the relationship is probably causal in nature*).
- Alcohol use may contribute to weight (fat) gain, and therefore contribute in an indirect way to those cancers which are associated with overweight and obesity.
- Greater body fatness is a convincing cause of cancers of the oesophagus, pancreas, bowel, endometrium, kidney and breast (in postmenopausal women)(7) (the WCRF and the AICR's strongest level of evidence, denoting a causal relationship*).
- Cancer Council recommends that to reduce their risk of cancer, people limit their consumption of alcohol, or better still avoid alcohol altogether.
- For individuals who choose to drink alcohol, Cancer Council Australia supports drinking only within the NHMRC Australian guidelines to reduce health risks from drinking alcohol *(42)
- The NHMRC guidelines are listed in abridged form in Box 2. Full text of the guidelines is available from: <http://www.nhmrc.gov.au/publications/synopses/ds10syn.htm>
- Cancer Council bases its recommendations about alcohol use on the weight of scientific evidence which has accumulated about the relationship between alcohol consumption and cancer.

*See reference (7), Section 3.5.2, p. 59

Box 2. NHMRC alcohol guidelines, abridged

The Australian standard drink contains 10g of alcohol (equivalent to 12.5 mL of pure alcohol). In Australia a standard drink is 100 mL wine (13.5% alcohol), a 285 mL glass of beer (~5% alcohol) or a 30 mL nip of spirits.

Guideline 1: Reducing the risk of alcohol-related harm over a lifetime

The lifetime risk of harm from drinking alcohol increases with the amount consumed. For healthy men and women, drinking no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury.

Guideline 2: Reducing the risk of injury on a single occasion of drinking

On a single occasion of drinking, the risk of alcohol-related injury increases with the amount consumed. For healthy men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion.

Guideline 3: Children and young people under 18 years of age

For children and young people under 18 years of age, not drinking alcohol is the safest option.

Guideline 4: Pregnancy and breastfeeding

Maternal alcohol consumption can harm the developing foetus or breast feeding baby.

A -For women who are pregnant or planning a pregnancy, not drinking is the safest option.

B -For women who are breast feeding, not drinking is the safest option.

The National Health and Medical Research Council states that, “the advice in the guidelines cannot be ascribed levels of evidence ratings as occurs with other NHMRC guidelines, due to the analytic approach taken in their development”. Guidelines one and four however are underpinned by evidence equivalent to NHMRC level III-1.

Process, acknowledgements

This statement was developed by Cancer Council Australia’s Alcohol Working Group with input from its Nutrition and Physical Activity Committee and reviewed by the organisation’s principal Public Health Committee. It has also been approved for publication by Cancer Council Australia’s Board.

This statement has also been peer-reviewed by the *Medical Journal of Australia* and, following amendments to the content as part of that process, was published by the MJA in April 2011. It can be accessed on the MJA website at: http://www.mja.com.au/public/issues/194_09_020511/win10641_fm.html

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References

- (1) Australian Institute of Health and Welfare. 2007 National Drug Strategy Household Survey: detailed findings. Drug statistics series no. 22. Cat. no. PHE 107. Canberra, Australia: Australian Institute of Health and Welfare; 2008.
- (2) Lewis M. A rum state: alcohol and state policy in Australia, 1788-1988. 1992. Canberra, Australian Government Printing Service.

Ref Type: Generic

- (3) Begg S, Vos T, Barker B, Stevenson C, Stanley L, Lopez A. The burden of disease and injury in Australia 2003. Canberra: AIHW; 2007.
- (4) National Preventative Health Taskforce. Australia: The Healthiest Country by 2020 National Preventative Health Strategy the roadmap for action. Canberra, Australia: National Preventative Health Taskforce; 2009.
- (5) World Health Organization and International Agency for Research on Cancer. IARC monographs on the evaluation of carcinogenic risks to humans. Volume 44. Alcohol drinking. Summary of data reported and evaluation. 1988. Lyon France, IARC.

Ref Type: Generic

- (6) International Agency for Research on Cancer. Monographs on the evaluation of carcinogenic risks to humans: alcoholic beverage consumption and ethyl carbamate (urethane). Lyon: IARC; 2007.
- (7) World Cancer Research Fund and American Institute for Cancer Research. Food, nutrition, physical activity and the prevention of cancer: a global perspective. Washington DC: AICR; 2007.
- (8) Fillmore KM, Chikritzhs T, Stockwell T, Bostrom A, Pascal R. Alcohol use and prostate cancer: A meta-analysis. *Molecular Nutrition & Food Research* 2009;53:240-55.
- (9) Gong Z, Kristal AR, Schenk JM, Tangen CM, Goodman PJ, Thompson IM. Alcohol consumption, finasteride, and prostate cancer risk: results from the Prostate Cancer Prevention Trial. *Cancer* 2009 Aug 15;115(16):3661-9.
- (10) Allen NE, Beral V, Casabonne D, Kan SW, Reeves GK, Brown A, et al. Moderate Alcohol Intake and Cancer Incidence in Women. *J Natl Cancer Inst* 2009 Feb 24;101(5):296-305.
- (11) Collaborative Group on Hormonal Factors in Breast Cancer. Alcohol, tobacco and breast cancer--collaborative reanalysis of individual data from 53 epidemiological studies, including 58,515 women with breast cancer and 95,067 women without the disease. *Br J Cancer* 2002 Nov 18;87(11):1234-45.
- (12) Corrao G, Bagnardi V, Zambon A, La VC. A meta-analysis of alcohol consumption and the risk of 15 diseases. *Prev Med* 2004 May;38(5):613-9.
- (13) Druesne-Pecollo N, Tehard B, Mallet Y, Gerber M, Norat T, Hercberg S, et al. Alcohol and genetic polymorphisms: effect on risk of alcohol-related cancer. *Lancet Oncol* 2009 Feb;10(2):173-80.

- (14) Seitz HK, Stickel F. Molecular mechanisms of alcohol-mediated carcinogenesis. *Nat Rev Cancer* 2007 Aug;7(8):599-612.
- (15) Collins D, Lapsley H. The costs of tobacco, alcohol and illicit drug abuse to Australian society in 2004/05. Canberra, Australia: Department of Health and Ageing; 2008.
- (16) English D, Holman CDJ, Milne E, Winter MG, Hulse GK, Codde JP, et al. The quantification of drug caused morbidity and mortality in Australia. AGPS; 1995.
- (17) Ridolfo B, Stevenson C. The quantification of drug-caused mortality and morbidity in Australia, 1998. Canberra: AIHW; 2001.
- (18) Australian Institute of Health and Welfare. Cancer in Australia: an overview, 2008. Canberra: AIHW; 2008.
- (19) World Cancer Research Fund and American Institute for Cancer Research. Policy and action for cancer prevention. Food, nutrition, and physical activity: a global perspective. Washington DC: AICR; 2009.
- (20) Collins D, Lapsley H. The avoidable costs of alcohol abuse in Australia and the potential benefits of effective policies to reduce the social costs of alcohol. National Drug Strategy Monograph No. 70. Canberra, Australia: Department of Health and Ageing; 2008.
- (21) US Department of Health and Human Services. The health consequences of smoking. Cancer. A report of the US Surgeon General. USA: Department of Health and Human Services, Public Health Service, Office on Smoking and Health; 1982.
- (22) Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S, et al. Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res* 1988 Jun 1;48(11):3282-7.
- (23) Wannamethee SG, Shaper AG, Whincup PH. Alcohol and adiposity: effects of quantity and type of drink and time relation with meals. *Int J Obes (Lond)* 2005 Dec;29(12):1436-44.
- (24) Food and Agriculture Organisation of the United Nations. Food energy - methods of analysis and conversion factors. FAO Food and Nutrition Paper 77. Report of a technical workshop Rome 3-6 December 2002. Rome, Italy: FAO; 2003.
- (25) Tolstrup JS, Halkjaer J, Heitmann BL, Tjonneland AM, Overvad K, Sorensen TI, et al. Alcohol drinking frequency in relation to subsequent changes in waist circumference. *Am J Clin Nutr* 2008 Apr;87(4):957-63.
- (26) World Health Organization. Prevention of cardiovascular disease. Guidelines for assessment and management of cardiovascular risk. Geneva: World Health Organization; 2007.
- (27) Fillmore KM, Stockwell T, Chikritzhs T, Bostrom A, Kerr W. Moderate alcohol use and reduced mortality risk: systematic error in prospective studies and new hypotheses. *Ann Epidemiol* 2007 May;17(5 Suppl):S16-S23.
- (28) Fuchs FD, Chambless LE. Is the cardioprotective effect of alcohol real? *Alcohol* 2007 Sep;41(6):399-402.

- (29) Jackson R, Broad J, Connor J, Wells S. Alcohol and ischaemic heart disease: probably no free lunch. *Lancet* 2005 Dec 3;366(9501):1911-2.
- (30) Naimi TS, Brown DW, Brewer RD, Giles WH, Mensah G, Serdula MK, et al. Cardiovascular risk factors and confounders among nondrinking and moderate-drinking U.S. adults. *Am J Prev Med* 2005 May;28(4):369-73.
- (31) Ronksley PE, Brien SE, Turner BJ, Mukamal KJ, Ghali WA. Association of alcohol consumption with selected cardiovascular disease outcomes: a systematic review and meta-analysis. *BMJ* 2011;342:d671.
- (32) National Heart Foundation of Australia. Position statement Antioxidants in food, drinks and supplements for cardiovascular health. National Heart Foundation of Australia; 2010.
- (33) National Health and Medical Research Council. Australian Alcohol Guidelines: health risks and benefits. Canberra: AGPS; 2001.
- (34) Stockwell T, Donath S, Cooper-Stanbury M, Chikritzhs T, Catalano P, Mateo C. Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction* 2004 Aug;99(8):1024-33.
- (35) Stockwell T, Zhao J, Chikritzhs T, Greenfield TK. What did you drink yesterday? Public health relevance of a recent recall method used in the 2004 Australian National Drug Strategy Household Survey. *Addiction* 2008 Jun;103(6):919-28.
- (36) Organisation for Economic Co-operation and Development Health Division. OECD Health Data 2008 - Frequently Requested Data. Alcohol consumption. Paris, France: OECD; 2008.
- (37) Australian Bureau of Statistics. Apparent Consumption of Alcohol, Australia, 2008-09. Canberra: Australian Bureau of Statistics; 2010.
- (38) White V., Hayman J. Australian secondary school students' use of alcohol in 2005. Monograph Series No. 58. Report prepared for Drug Strategy Branch, Australian Government Department of Health and Ageing, by the Centre for Behavioural Research in Cancer, Cancer Control Research Institute, The Cancer Council Victoria. Canberra, Australia: Department of Health and Ageing; 2006.
- (39) Australian Institute of Health and Welfare. Australia's health 2008. Cat.no.AUS 99. Canberra, Australia: AIHW; 2008.
- (40) Vos T, Barker B, Stanley L, Lopez A. The burden of disease and injury in Aboriginal and Torres Strait Islander peoples, 2003. Brisbane, Australia: School of Population Health, University of Queensland; 2007.
- (41) Threlfall T, Thompson J. Cancer incidence and mortality in Western Australia, 2007. Perth, Australia: Department of Health; 2009.
- (42) National Health and Medical Research Council. Australian guidelines to reduce health risks from drinking alcohol. Canberra: NHMRC; 2009.